Diameter (minimum): 29′ 23″.65.

Mass: $\left\{\begin{matrix}0.01228\\ \frac{1}{81.40}\end{matrix}\right\}$ of the earth's.

Revolution of perigee (mean): 3232.575 days; 8.8505 years.

Advance of perigee each year (mean): 40° 40′ 31″.1.

Revolution of nodes (mean): 6793.391 days; 18.5997 years.

Regression of nodes each year (mean): 19° 21′ 18″.3.

Maximum geocentric libration in longitude: 7° 53′ 51″.0.

Maximum geocentric libration in latitude: 6° 50′ 45″.0.

Maximum parallactic libration: 1° 1′ 35″.0.

Maximum geocentric libration: 10° 25′ 22″.0.

Maximum libration (total): 11° 25′ 30″.

Surface of the moon never seen: .4100.

Surface of the moon that is visible at one time or another: .5900.

Angle subtended by one degree of selenographical latitude and longitude at the centre of the moon's disc, when at its mean distance: 16″.566.

Length in miles of the same: 18.871.

Selenographical arc at centre of the moon's surface, subtending an angle of one second of arc: 3′ 37″.31.

Miles at the centre of the moon's disc subtending an angle of one second of arc: 1.139.

Surface: $\left\{\begin{matrix}0.074478\\ \frac{1}{13.43}\end{matrix}\right\}$ of the earth's.

Volume: $\left\{\begin{matrix}0.02033\\ \frac{1}{49.20}\end{matrix}\right\}$ of the earth's.

Density: $\left\{\begin{matrix}0.60419\\ \frac{1}{3.444}\end{matrix}\right\}$ of the earth's (water being unity).

Action of gravity at the surface: $\left\{\begin{matrix}0.16489\\ \frac{1}{6.065}\end{matrix}\right\}$ of the earth's.

Horizontal parallax (constant of): 57′ 2″.325.

Eccentricity of orbit (mean): 0.05490807.

Inclination of orbit (mean): 5° 8′ 39″.96.

Inclination of axis to ecliptic: 87° 27′ 51″.0.

Inclination of equator to ecliptic: 1° 32′ 9″.0.

Inequalities in the moon's longitude—

Equation of the center (maximum): 6° 17′ 19″.06.
Evection (maximum): 1° 16′ 27″.01.
Variation (maximum): 39′ 30″.70.
Annual equation (maximum): 11′ 9″.00.
Parallactic equation (maximum): 2′ 4″.70.

Inequalities in the moon's latitude—

Evection: 8′ 57″.37.
Variation: 33″.44.

Announcement of the Discovery of the Rotation Period of *Mercury*, by M. Schiaparelli.

On the 8th of December, 1889, the *Accademia dei Lincei*,* of Rome, held a special sitting, which the King and Queen of Italy

* Galileo was one of the original members of this Academy (*dei Lincei*—of the Lynxes—of the sharp-eyed ones), which was named after the fantastic manner of the day.

attended, in order to hear a discourse by M. SCHIAPARELLI on his discovery of the rotation period of the planet *Mercury*.

From a report of this meeting and from a short paper in the *Astronomische Nachrichten*, the following brief account is condensed.

The rotation periods of the planets *Mercury* and *Venus* must be fixed, if at all, by the observation of the spots on their surfaces. Neither of these planets is ever to be found at any considerable angular distance from the sun, so that they must be observed in the twilight or in the daytime. At all observatories the images of planets in the daytime are wavering and unsteady, and at some stations (as at the Lick Observatory, for example,*) daylight observations can almost never be made to advantage. At Milan, M. SCHIAPARELLI has been able to observe *Mercury* some 150–200 times in the years 1881–6 with the eight-inch telescope; and since that time he has used the eighteen-inch telescope, which has confirmed his earlier conclusions.

The fundamental facts relating to the rotation of the planet are:

I. If *Mercury* is observed on two consecutive days, the aspect of its spots is identical or nearly so; and the same is true when the interval between observations is two, three or four days, etc. This fact of observation can be explained by either one of three hypotheses —(*a*) the rotation period of *Mercury* is about twenty-four hours; (*b*) or the planet makes two or more rotations in this period; (*c*) or the rotation is so slow that an interval of two or three days makes no appreciable alteration in the position of the markings.

II. The observations at Milan showed Professor SCHIAPARELLI, to his satisfaction, that the motion of the spots on the apparent disc was too slow to permit of the possibility of the hypotheses *a* or *b*. It followed, therefore, that the rotation period was of *many* days.

III. Observations in 1882–3, confirmed in 1886–7, showed that the planet revolved about the sun at least somewhat as the moon revolves about the earth, namely: in turning always the same face, or nearly the same face, to the primary body. The observations themselves were so difficult that it was impossible to prove that *Mercury* revolved on its axis *exactly* in the period of one revolution in its orbit (as in the case of the moon). Professor SCHIAPARELLI takes the sidereal period of *Mercury* (87.9693 days) at once as its rotation time, although his observations might be satisfied by a period some four hours or so different from this, longer or shorter.

* See *Publications of the Astronomical Society of the Pacific*, Vol. II, p. 27.

IV. The observations were too difficult to permit the determination of the position of the rotation axis, but all his drawings agree with the assumption that the axis of rotation is approximately perpendicular to the plane of the orbit. It is certain that the axis is not inclined as much as 23° or 25° (like the earth's or *Mars'*), and it is not likely that the inclination varies from 90° by as much as 8°.

V. All the observations tend to demonstrate that the rotation of the planet on its axis is uniform; from which datum, combined with the notable eccentricity of *Mercury's* orbit, it follows that there must be a large libration in longitude with respect to the radius-vector. The period of this libration is eighty-eight days, and its amplitude is twice the maximum equation of the center, or 47° 21′.

The author dwells on the extreme difficulty of seeing the faint markings at all, and of depicting them when seen, but gives a planisphere of the hemisphere turned towards us. On the equator three points are marked O (center of the disc) and two points A and B, 23° 41′ from O, and on either side of it. O is the point turned towards the sun (the point which has the sun in the zenith) at the times of perihelion and aphelion; A and B are the two points which have the sun in the zenith at the times of greatest positive or negative libration.

Considering the difficulty of seeing the spots on *Mercury* at all, it is not easy to give any well-founded opinion as to their nature. They may simply depend upon the diverse materials and the structure of the solid strata of the surface, as in the case of our own moon. But, as *Mercury* is known to have a dense atmosphere, Professor SCHIAPARELLI thinks that it would not be unreasonable to conclude that they might be analagous to our own seas. With regard to this point, he says: "We have in the case of *Mercury* (as in *Mars*), a world which is sufficiently diverse from our own; which receives light and heat from the sun, not only in a greater amount but in a different manner from the earth; and where life, if so be life exists there, finds conditions so different from those to which we are accustomed that we can scarcely imagine them. The perpetual presence of the sun almost vertically above certain regions, and its perpetual absence from other regions, appears to us to be something intolerable. But we must recollect that such a contrast should produce an atmospheric circulation which is at the same time stronger, more rapid and more regular than that which sows the elements of life on the earth; and that on this account it may come about that an equi-

librium of temperature which is far more complete than with us is produced over all the planet."

The foregoing is a very brief summary derived from the important and elegant papers which have already been published in advance of the more elaborate memoir in which Professor SCHIAPARELLI will discuss all his observations for the years 1881–1889. As early as 1882, M. SCHIAPARELLI announced to one of his correspondents (M. TERBY) his discovery in the verses which follow :

Cynthiæ ad exemplum versus Cyllenius axe
Æternum noctem sustinet, atque diem :
Altera perpetuo facies comburitur æstu,
Abdita pars tenebris altera Sole caret.

* * * * *

In 1888, Professor SCHIAPARELLI asked the attention of the astronomers of the Lick Observatory to the inferior planets, and Mr. SCHAEBERLE, Mr. BARNARD and myself have observed *Venus* and *Mercury* in the daytime on a very great number of occasions with the meridian-circle and with the twelve-inch equatorial, but with little success. For reasons which I have given in full in the Handbook of the Lick Observatory (page 26), we shall never be able to make delicate observations in the daytime at Mt. Hamilton. A station on one of the very small coral islands of the South Pacific Ocean has the very best conditions for this class of observations,* and a mountain observatory has the very worst. On only one occasion during the past two years was it worth while to turn the great telescope upon *Venus* in the daytime, and for a very few moments the view was somewhat better than it had been in the twelve-inch.

If the observations of M. SCHIAPARELLI require confirmation, an expedition to one of the smaller *atolls* of the Pacific would yield the surest and the quickest results. E. S. H.

* As is evident, *a priori*, and as I had occasion to learn practically during my stay on Caroline Island, in April and May, 1883.